ASSOCIATION OF
FEDERAL COMMUNICATIONS CONSULTING ENGINEERS
WASHINGTON, D. C.

July 11, 1996

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW Room 222
Washington, DC 20554

Re: Comments of Association of Federal Communications Consulting Engineers (AFCCE)

Dear Mr. Caton:

Enclosed are 11 copies (original and 10) of the response by the Association of Federal Communications Consulting Engineers (AFCCE) regarding MM Docket No. 87-268, In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service.

If there are any questions, please do not hesitate to contact this Association at (202) 898-0111.

Sincerely,

S. K. Khanna

SKK:cc
Encl.

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of

Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service	))))	MM Docket No. 87-268

FIFTH FURTHER NOTICE OF PROPOSED RULE MAKING

COMMENTS OF THE ASSOCIATION OF FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

These comments on the Fifth Notice of Proposed Rule Making (Fifth Notice) in the above captioned matter are submitted on behalf of the Association of Federal Communications Consulting Engineers (AFCCE). AFCCE is a professional organization whose members are professional engineers practicing as consultants to broadcasters and other segments of the communications industry, communications company engineering executives, representatives of equipment manufacturers and others working in the communications arena. AFCCE has a long history of participation in FCC rule making proceedings dating back to its founding nearly fifth years ago and welcomes this opportunity to submit its Comments to the Commission. In order to properly address the issues raised in this Docket, AFCCE formed an Ad Hoc Committee composed of 10 association members who are representative of a broad cross-section of the broadcast industry including consulting engineers, broadcasting group operators, manufacturers and communications tower owners. As AFCCE is primarily a technical/engineering organization, it has elected to limit its comments to those aspects of the NPRM which deal with technical issues. AFCCE has previously filed comments in this docket and wishes to continue with its comments to the Fifth Notice.

In general, AFCCE supports the adoption of the Grand Alliance system as the standard for high definition ATV. The MPEG standard that is a part of the Grand Alliance system will permit broadcasters to have the flexibility to use their assigned channel for program transmission formats other than HDTV. The interoperability aspects of the standard are key to its adoption as the all-digital system; its features should satisfy even those from non-television industries who clamor for an inflexible standard based on a single scanning mode, i.e., progressive scanning. It is essential that the Commission establish technical standards to allow for the orderly introduction, implementation and growth of the new digital television service. AFCCE also reiterates the need for the Commission to adopt standards for ATV receivers which will set forth the minimum requirements for such characteristics as noise figure, equalizer range and adjacent channel signal immunity, among others, so that the planning factors on which channel allotments are based will result in the best possible service to the public.

AFCCE is concerned about several technical issues raised in the FNPRM and some of these concerns are addressed below.

Power Measurements

In paragraph 58, the Commission discusses the measurement of ATV power and proposes that "...conventional RMS average power meters" be used to measure a station's TPO. Assuming the proposal refers to both time-domain (envelope detection) and frequency domain (spectrum analyzer) integration and, assuming an accurate calibration (± .1 dB) is at hand, the RMS power may not be an adequate indicator.

Consider two 6 MHz power ATV spectra at the transmitter room wall, one for a good system and one for a less than perfect system. Both spectra will integrate to the same power level yet the distorted spectrum will provide more interference to a co-channel NTSC station.

Further, knowledge of the peak power is also critical for interference compliance for it is the occasional instantaneous excursion from an undesired co-channel that may freeze the HDTV channel. The true peak power, the potential cause for short term interference, should be measured at the wall to account for any ringing produced by the passive components between the output of the transmitter and the wall

In short, the transmitter monitoring would best be performed by two instruments the peak/average power meter and the spectrum analyzer developed for digital transmitters by at least two companies. The FCC would then require that the incremental power at the co-channel carrier not exceed the incremental RMS power and that the peak power not exceed 7 dB above the average value.

Field Strength

In paragraph 73, the Commission refers to the ACATS final report regarding the use of field strength measurements.

"An objective measurement that should permit reliable prediction of satisfactory service at UHF is field strength." In fact, HDTV field strength was never measured. HDTV field strength cannot be measured because there is no carrier to tune to and even if there were, it cannot serve as a predictor of service. The conversion process, from the measured total signal power in 6 MHz to incident field strength at the receive antenna as used in the field test report (not documented in the report) is not applicable to HDTV.

Unlike NTSC, the 6 MHz spectrum of HDTV shows no distinct carrier, only a signal acquisition pilot. RF field strength is measurable by a narrowband tunable receiver at a single frequency provided the field stays constant during measurement. The "field strength" of the HDTV signal is random and fast-changing because it depends on the picture content, and the data rate is high.

How, then, was the field-strength data reported even though it could not be measured? It appears to have begun with the averaged measured total signal power in 6 MHz. That power is represented by the area under the power spectrum curve as seen on the spectrum analyzer. Next, the conventional NTSC formula that relates the measurable received power to the incident field strength was invoked:

$$P = \frac{E^2}{120\pi} \quad \frac{G\lambda^2}{4\pi}$$

G = Gain of RX antenna relative to isotrope
E = Field Strength
λ = Wavelength

To determine the field strength for HDTV using the conventional formula, a wrong assumption had to be made -- that all of the HDTV power is concentrated at a single frequency (carrier) rather than being spread, generally not uniformly, across the channel. In any case, the value obtained is a derived quantity, not a measurable field strength of the HDTV carrier; the derived field strength using the conventional formula can play a role in service planning. Measurements of the HDTV pilot carrier's field strength might be possible, but the pilot's field strength alone cannot be used as a coverage predictor because the shape of the spectrum must also be accounted for in the prediction of realistic coverage.

Time Availability

AFCCE has previously commented on its concerns regarding the assumption of a time availability factor of 90%. The NTSC values of a minimum of 90% of time for signal and a maximum of 10% of time for interference are unlikely to be acceptable for HDTV. If the NTSC values are to be used for HDTV, viewers' perception of HDTV will not be that of comparable service to NTSC. That is because in NTSC the result of exceeding these values is picture fading and but not loss of audio, whereas in HDTV both could be lost. Therefore, HDTV signal availability must be higher than 90% and co-channel interference less than 10% before adequate (comparable) service is established. Another issue is the prediction of coverage. There can be no principal city, A and B contours for HDTV.

Planning Factors

These are part of the ATSC standard and are another unfortunate adaptation of the NTSC factors. The problem lies in using the geometric mean frequency for those factors that depend on frequency. The resultant disparity between channel 14 and 69, including downlead losses, would be at least 5.5 dB. That is, channel 69 would need more than three times the transmitter power than channel 14 to achieve equivalent CNR at the input of the receiver. In short, because HDTV is a yes/no situation where 0.5 dB makes the difference between yes and no, the planning factors must be channel-specific if parity among all channels is the objective.

Transmission Mask and Adjacent Channel Operation

The Commission's proposal for a transmission mask needs to be further clarified. The following questions should be considered:

> *Precisely* where would the mask be laid over the spectrum?
>
> The HDTV spectrum looks like random noise with fluctuations as high as ±3 dB around the mean level. Should the top of the mask line up with the in-channel peaks or minima?
>
> Should the out-of-channel mask line up with the peaks or the minima? Without precise definition, a 6 dB "error" can be expected.

Consider the following cases as examples of the concerns underlying these questions.

Case I: HDTV channel adjacent to NTSC channel

There are two UHF-NTSC stations serving the same market. One is full-power and successful. The second is at 1000 kW and struggling. The struggling NTSC station is assigned an adjacent HDTV channel. If the struggling station has to operate at -12 dB (63 kW average HDTV) relative to its NTSC level with the proposed mask, it may not be able to match its more powerful competitor unless it raises the NTSC ERP first. But that door may be closed if the FCC freezes filings for changes in CPs or permanently allocates lower HDTV power to the struggling station based on its current ERP.

Case II: Adjacent HDTV channels

Even if they are assigned equal power and are colocated, serious interference may be present within a few miles of the transmitter because the two signals will vary significantly relative to each other. This interference could theoretically be avoided if the two stations were to be diplexed on the same antenna. Unfortunately, practical equipment for such an operation is not available in the UHF band unless severe performance degradation of both channels is acceptable.

In short, the mask should be based on a maximum allowable power and the assignment of co-channels should be re-examined.

Pilot Frequency Offset

At paragraph 57, the Commission discusses the need for a precise ATV pilot carrier offset of 5.082138 MHz relative to the visual carrier of the lower adjacent NTSC station. AFCCE has several concerns with this requirement.

First, there may be more than one station operating on the "lower adjacent NTSC channel" which could be affected; if this condition exists, these lower adjacent channel stations would necessarily be operating with different standard (±10 kHz) carrier offsets to meet co-channel (NTSC) criteria. Which visual carrier frequency will be used as a reference? What distance separation criteria will be used to determine whether a lower adjacent NTSC channel must be so protected?

Secondly, the Commission states that the difference frequency between the ATV pilot and the NTSC visual carrier must be maintained within ±3 Hz. How will this be possible if the NTSC station's carrier is presently permitted to vary ±1 kHz? Will NTSC stations have to install precise carrier frequency control to maintain this level of stability? Should the ATV station be required to lock its pilot carrier to the NTSC carrier to maintain the precision offset? If it is not possible to meet this stability requirement because of the issues raised above, should there be separate allotment/interference criteria for "non-offset" stations?

There are other similar questions relating to stations in the LPTV/Translator service; perhaps their unprotected secondary status is the reason that issues related to these stations are not discussed in the Fifth Notice.

Conclusion

In earlier comments in this proceeding, AFCCE expressed concerns regarding some of these issues and to the extent they involve "planning factors", how the proposed table of allotments would be impacted by any changes. AFCCE remains concerned that there are what appear to be significant technical issues regarding these planning factors which need to be resolved. AFCCE presumes that the soon-to-be released proposed table of allotments will contain a discussion of the planning factors used to determine service and interference parameters and how these factors were applied in the channel allotment model.

Respectfully submitted,

AFCCE ATV ADVISORY COMMITTEE

John F.X. Browne, P.E.
Chairman

ASSOCIATION OF FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

Sudhir K. Khanna, President